FIRE HISTORY FOR THE BIRCH CREEK DRAINAGE
BEAVERHEAD FOREST

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INTRODUCTION

A field investigation of the Birch Creek drainage was conducted during the summer of 1992. The objective of this study was to develop a generalized fire history for vegetation types in eastern Montana. The information will also provide site specific information for the Birch Creek drainage.

STUDY SITES

Four sites in Birch Creek were sampled in this analysis ranging in elevation from 6300 to 8900 feet. Site 1 was in the area of the CCC Camp in main Birch Creek; Site 2 covered the Tower Mountain area; Site 3 was in the vicinity of Dinner Station; and Site 4 was in the area around Cow Camp.

Data was collected from the low drainage bottom sites to the high elevation whitebark pine communities on Tower Mountain. Data on the high elevation sites is limited however. No information was collected for the grassland types. Additional studies will be necessary to fully understand the fire process within the grassland types.

METHODS

There were two primary sources of information that were studied during the field investigation: fire scars within the study area and age structure of the stands. A series of ECODATA plots were located on various aspects and elevations to sample the variety of vegetation conditions. A search of the area was made to locate fire scarred trees. Where possible a wedge was removed from the tree showing the fire scar sequence. In cases where it was not safe to remove a wedge because of rot, lean or severity of the scar, the tree was felled and a slice taken from the fire scar region. A chainsaw powered increment borer was used to collect cores from at least three trees in each age class on or adjacent to the ECODATA plot. All age cores and fire scar blocks were taken to the office, sanded and age counted under a binocular microscope. The actual date of a fire event is subject to some uncertainty. Fire scar counts may be in error as a result of false or missing rings or rings masked by pitch or rot. Counts on dead trees or stumps are also dependent on identifying the year the tree died or was harvested. Aging a fire event from the origin of a stand has even more uncertainty. Not only must an estimate be made of the years taken to grow to the sampling height on the tree but also an estimate of the time delay after the fire until a new stand was established. For these reasons fire events based on fire scars may vary plus or minus two to three years while those based on stand age may vary 5 to 10 years. All estimates of fire return intervals are calculated from 1930 and earlier. It is assumed that after 1930 fire control effectiveness impacted the fire return cycle.

RESULTS

During the period between 1234 and 1930 about 25 fires were recorded by fire scars or stand origin information. A fire return interval for the drainage of 28 years is indicated. Because data is limited before 1600 a more realistic fire return interval may be closer to 16 years. The period between 1740 and 1860 had the most frequent fire occurrence and averaged a fire every 13 years. After 1860 the number of fires dropped by 40 percent which could reflect the development of the grazing industry in the Dillon area. Evidence for large fires that may have impacted the entire drainage is

limited and difficult to interpret. Samples of fire scars do not have similar aged scars from one drainage to the next. Some of the birth dates for a stand or portion of a stand are similar to other portions of the drainage however. It would seem that the very light fuels resulted in few fire scars and consequently in a very limited fire scar record. A major fire impacted three of the four sites only in 1779. About 42 percent of the fires affected two or more of the sites which suggests that fires covering thousands of acres were not uncommon, however, there is limited evidence that a fire in the tens of thousands of acres may have occurred. As mentioned above fire frequencies declined after 1860 and neither the 1889 or 1910 fire years were evident in the record. Although no direct information is present for 1910 there was a major stand establishment in 1915 and this may be a delayed response to that fire year. No fire scars were found from this period. The last fire scar occurred in 1899 on Tower Mountain and 1854 near Cow Camp.

There does not seem to be a difference in fire severity by time period except before 1740. I feel this is the result of an incomplete record rather than a true reduction in the number of large fires.

TABLE 1 - NUMBER OF FIRES BY TIME PERIOD BY NUMBER OF MAJOR DRAINAGES IMPACTED

TIME PERIOD	NUMBER OF DRAINAGES IMPACTED			
	1	2	3	4
1900-1940	2	0	0	0
1860-1900	0	2	0	0
1820-1860	2	1	0	0
1780-1820	0	2	0	0
1740-1780	3	2	1	0
1700-1740	3	0	0	0
1660-1700	0	3	0	0
1620-1660	0	1	0	0
1580-1620	1	0	0	0
1540-1580	1	0	0	0
1500-1540	1	0	0	0
1460-1500	2	0	0	0

Age structure was very complex and varied both within the major drainages as well as within each fire group. Of the areas sampled about 25 percent had a single age component representing a stand replacement fire sometime in the past. Two of these stands were composed of lodgepole pine and were established by a fire in about 1847. Even in these stands there is enough variation in ages to suggest that the stand resulted from more than one disturbance. About 70 percent of the plots contained three or more age classes. Cover classes included Douglas-fir as well as lodgepole pine stands. These stands were on dry sites and generally have limited understory vegetation. Stand ages were typically some of the oldest encountered during the study with 400 year old trees not uncommon. One whitebark pine was aged at 758 years.

SAMPLE SITES

CCC CAMP - This area included the lower portion of Birch Creek to the old CCC Camp site.

Habitat types were a mixture of Douglas fir/ juniper, Douglas-fir/ pinegrass and Douglas-fir/ Idaho fescue. The oldest tree sampled was 517 years of age with 50 percent of the sampled trees over 235 years. Stands were very dry with limited ground vegetation. Fires would have been of low intensity. It is very probable that a number of the fires in this site did not result in scaring on the live trees. This idea is supported by a number of stand age components that do not have a corresponding scar on the sampled fire scar trees. This makes it very difficult to determine if the variation in tree age is the result of a delayed response to a single fire or the result of a fire that did not scar the trees that were present. It was assumed if the difference in ages was greater than about 10 years that another fire event had covered the area. Using this approach the fire return interval for the stand was 37.5 years between 1517 and 1930. If only the 1740 to 1930 period is used the return interval is about 32 years. This second figure may be more accurate as there are more observations for the period. The longest fire free period may have been 66 years, however, this occurred in the late 1500's and may represent limited information.

TOWER MOUNTAIN - This area had one of the oldest records dating to 1234. About 50 percent of the sampled trees were over 260 years of age. Stands had as many as five age classes on a plot. Habitat types were variable including Douglas-fir/juniper, Douglas-fir/mountain snowberry, Subalpine fir/heartleaf arnica and some high elevation whitebark pine/subalpine fir. Site conditions were similar to that described above and fires were probably of low intensity. The fire interval averaged about 22 years between 1602 and 1930. The longest fire free period was 41 years.

DINNER STATION - This site had the youngest stands as well as a simple stand structure. The stand appears to be the result of a fire in about 1846 with possibly another fire in 1859. This was one of the two areas sampled that suggested a stand replacement fire. There was no indication of any other fires between 1859 and 1930 which would result in a fire free period of 71 years. No information of previous fire events was observed. Habitat types were a mixture of Douglas-fir/pinegrass and Douglas-fir/elk sedge.

COW CAMP - The age structure was similar to the CCC Camp site with the oldest tree 528 years of age and 50 percent of the sampled trees over 190 years of age. The fire return interval for the entire period was 39 years but this is distorted by limited information before 1670. Using data from 1670 results in an interval of 24 years and a 1740 to 1930 period indicates a frequency of 21 years. Habitat types varied from Douglas-fir/juniper and Douglas-fir/pinegrass to subalpine fir/pinegrass. Stands are composed of three or more age classes with age classes somewhat more distinct than found at the CCC Camp site. The longest fire free period was 50 years.

TABLE 2 - NUMBER OF FIRES BY TIME PERIOD BY MAJOR DRAINAGE

			DRAINAGE		
TIME PERIOD	CCC CAMP	TOWER MTN.	DINNER STATION	COW CAMP	TOTAL*
1900-1940	1	0	0	1	2
1860-1900	0	2	0	2	2
1820-1860	1	1	1	1	3
1780-1820	1	1	-	2	3
1740-1780	3	2	-	3	6
1700-1740	1	2	-	0	3

TIME PERIOD	CCC CAMP	TOWER MTN.	DINNER STATION	COW CAMP	TOTAL*
1660-1700	1	3	-	2	3
1620-1660	1	1	-	0	2
1580-1620	0	1	-	0	1
1540-1580	1	0	-	0	1
1500-1540	1	0	-	0	1
1460-1500	1	0	-	1	2

*Does not equal the total for sites as some fires burned in more than one site.

FIRE GROUPS

The fire cycles were analyzed using the fire groups developed by Fisher et al (1983). The majority of sites sampled were in fire group 5 and 6. Fire Group 7, 8 and 10 were also encountered. The fire return period for the Group 6 types averaged about 55 years at the plot level and about 48 years at the stand level. This compares to an east side average of 42 years (1983). The longest fire free interval was about 90 years at the stand level.

Fire Group 5 was also represented and had a plot level fire return period of 49 years. The shortest plot interval was about 28 years. The stand level return interval averaged about 47 years. Fire intervals for the east side suggest this type should average about 5 to 20 years. Excluding the data from the Dinner Creek site results in a return of about 30 years. The longest fire free period at the stand level was about 109 years. Again because of the type of fires and fuel loadings on these sites it is uncertain if all events have been included.

Fire Group 8 had a limited number of observations. The fire return interval was 54 years at the stand level and between 43 and 66 years at the plot level. East side data suggests an average of between 50 and 90 years.

Information for Fire Group 10 was found on one plot. This plot averaged a fire return of 86 years. The average fire return is considered highly variable for this group and may not play a significant role in stand dynamics. The particular stand that was sampled was an even aged stand of whitebark pine 235 years of age. A fire scarred tree nearby contained this scar plus a scar in 1766 and 1847. While it is not clear if these fires visited this stand it certainly raises questions about the frequency and regularity of fire in this environment. At this point there is not enough information to address this concern.

CONCLUSIONS

1. Stand replacement fires apparently were not particularly common in this drainage.

2. Fires in the Douglas-fir stands were generally underburns resulting in a multi-aged stand structure. Many of these sites have escaped stand replacement fire for many centuries.

3. Fire events in the lodgepole pine cover type generally responded to the site environment with stand replacement fires found on the sites where fuel accumulations could occur. Other stands

particularly in Fire Group 8 and parts of Fire Group 6 had a multiple age structure. What stand replacement fires that did occur probably were of relatively small size and may represent one "run". Fires may typically have been a mixture of under burn and partial burns with an individual "run" that was a stand replacement event.

4. Major fires which covered significant portions of Birch Creek may have been limited. There is evidence that only one major fire occurred between 1740 and 1930. Even is a fire did cover significant portions of the drainage in a particular fire year, there was limited impact on the stand structure when compared to similar events elsewhere.

5. The fire of 1899 was probably the last major fire.

6. While some fire free periods were found that exceeded 110 years, stands more commonly were fire free for about 50 years.

7. Stand ages were some of the oldest found in studies to date suggesting a relatively low intensity fire. The oldest Douglas-fir sampled was about 528 years of age.

8. Fires probably were ignited on site and starts in the major valley grasslands may not have played a significant role. Grasslands within the drainage, however, may have been important in fire spread. Introduction of cattle grazing into this system may have significantly reduced the ability to carry fire through much of the drainage.

9. Fire scar information was limited in this analysis and stand component birth dates were used extensively. A significant error in determining fire years could occur if regeneration continued over an extended period.

BIRCH CREEK DRAINAGE - BEAVERHEAD FOREST
FIRE HISTORY

FIRE	AREA			
	CCC	TOWER	DINNER	COW
YEAR	CAMP	MTN.	STATION	CAMP
1941				X?
1915				B
1903	B			
1899		XB		B
1875		B		B
1859			B+/-	
1854				XB
1847		X	B	
1839	B			
1816		X		B
1801	B			XB
1779	XB	B		B
1766		X		
1760				X
1757	B	XB		
1746				B
1740	XB	B		
1728		B		
1716		B		
1702	XB			
1691		B		B
1670		B		B
1663	B	B		
1632	B	B		
1602		XB		
1566	B			
1517	B			
1475	B			
1464				B
1234		B		

X = Fire scar
B = Birth date of stand or portion of stand

REFERENCES

Fisher, William C.; Clayton, B.D. 1983. Fire ecology of Montana Forest Habitat types east of the Continental Divide. USDA, Forest Service Gen. Tech. Rep. INT-141. Intermountain Forest and Range Experiment Station, Ogden, UT. 83p.

Pfister, Robert D., Bernard L. Kovalchik, Stephen F. Arno, and Richard C. Presby 1977. Forest habitat types of Montana. USDA For. Serv. Gen. Tech. Rep. INT-34. Intermountain Forest & Range Experiment Station, Ogden, UT 174p.

APPENDIX A VEGETATION DATA

PLOT #	LOCATION	HABITAT TYPE	ELV	ASP	AGE	DOMTRE	TREES/AC	BASAL AREA	DBH	HT	PLANT COVER		
											SHRUB	GRAM	FORB
101	S22,T5S,R10WCCC	DF/juniper	7120	336	420	DF	150	80	14	40	1	1	0
102	S9,T5N,R10WCCC	DF/pinegrass-pinegrass	6300	212	200	DF	160	70	15	45	0	1	0
103	S9,T5S,R10WCCC	DF/Idaho fescue	6430	195	265	DF	50	80	14	51	0	3	0
104	S9,T5SR10WCCC	DF/Idaho fescue	6440	188	243	DF	170	90	18	41	0	3	0
105	S6,T5S,R10WDINNER	DF/pinegrass – pinegrass	6890	85	141	LP	360	180	8	53	3	1	0
106	S6,T5S,R0WDINNER	DF/elk sedge	6990	343	140	LP	380	110	10	70	0	1	20
107	S28,T4S,R10W S5,T5S,R10WCOW	DF/pinegrass – pinegrass	7060	251	93	LP	170	70	12	61	40	3	0
108	S20,T4S,R10W COW	AF/pinegrass	6730	231	260	LP	160	90	10	44	10	3	0
109	S29,T4S,R10W COW	DF/juniper	6710	153	385	DF	120	120	20	67	0	0	0
110	S7,T5S,R10WTOWER	DF/juniper	7760	353	268	DF	440	125	20	50	10	0	1
111	S7,T5S,R10WTOWER	AF/heartleaf arnica	7920	5	332	LP	290	60	8	45	3	0	10
112	S18,T5S,R10W TOWER	DF/mountain snowberry	8320	142	97	WBP	210	90	10	44	50	1	0
113	S18,T5S,R10W TOWER	WBP-AF	8910	185	232	WBP	710	200	8	38	1	0	0